

Patent claims

1. Arrangement for generating ultrashort laser pulses with a solid-state laser oscillator for providing a pulse sequence and a downstream multistage laser amplifier for increasing the pulse energy of pulses that are selected by at least one circuit element from the pulse sequence with a reduced pulse repetition rate compared to the pulse sequence, whereby said laser amplifier has no resonator and is free of active circuit elements with respect to the pulse to be amplified and has no more than one double pass of the pulse to be amplified, characterized in that one small-signal amplification of more than 10 is provided for each amplifier stage in an amplifying laser crystal (12 – 17), whereby the total small-signal amplification caused by all amplifying laser crystals is greater than 100.
2. Arrangement in accordance with claim 1, characterized in that said laser amplifier (2) as laser-active element is arranged in a resonator that is effective for a second wavelength (λ_2) other than a first wavelength (λ_1) provided for further use of the pulse to be amplified or for a second polarization component that is oriented orthogonal to said first polarization component provided for further use.
3. Arrangement in accordance with claim 2, characterized in that two dichroitic beam splitters (37, 38) are adjacent to said laser amplifier (2) and are embodied transmitting for said first wavelength (λ_1) or for said first polarization component of said pulse to be amplified and highly reflecting for said second wavelength (λ_2) or said second polarization component, whereby said second wavelength (λ_2) or said second polarization component are directed by said beam splitters (37, 38) to the resonator mirror (39, 40), of which one is highly reflecting for said second wavelength (λ_2) or said second polarization component and the other decouples said second wavelength (λ_2) or said second polarization component.
4. Arrangement in accordance with any of claims 1 through 3, characterized in that said circuit

element is an acoustooptical modulator (3) that is arranged between said solid-state laser oscillator (1) and said amplifier input of said laser amplifier (2).

5. Arrangement in accordance with claim 4, characterized in that said acoustooptical modulator (3) is triggered by a photodiode that determines the selection of the pulses in conjunction with an electronic counter.
6. Arrangement in accordance with any of claims 1 through 3, characterized in that two acoustooptical modulators (35, 36) are arranged as circuit elements one after the other between said solid-state laser oscillator (1) and said amplifier input of said laser amplifier (2).
7. Arrangement in accordance with claim 1, characterized in that the pulse repetition rate is variable by adjusting the pulses to be selected in a time unit.
8. Arrangement in accordance with any of claims 1 through 3, characterized in that said circuit element is an electrooptical modulator that is arranged between said solid-state laser oscillator (1) and the amplifier input of said laser amplifier (2).
9. Arrangement in accordance with any of claims 4 through 8, characterized in that said circuit element is additionally provided as optical isolator between said solid-state laser oscillator (1) and said laser amplifier (2) for avoiding interference from said laser amplifier (2) in said solid-state laser oscillator (1).
10. Arrangement in accordance with any of claims 1 through 3, characterized in that a Faraday isolator (19, 44) is arranged between said solid-state laser oscillator (1) and said laser amplifier (2) for avoiding interference from said laser amplifier (2) in said solid-state laser oscillator (1).
11. Arrangement in accordance with any of claims 1 through 10, characterized in that said solid-

state laser oscillator (1) is diode-pumped and mode-coupled.

12. Arrangement in accordance with any of claims 1 through 10, characterized in that said solid-state laser oscillator (1) is embodied as Q-switched, highly-repetitive pulsed oscillator.
13. Arrangement in accordance with any of claims 1 through 10, characterized in that said solid-state laser oscillator (1) is embodied as passive Q-switched oscillator.
14. Arrangement in accordance with any of claims 1 through 10, characterized in that said solid-state laser oscillator (1) is embodied as microchip laser.
15. Arrangement in accordance with any of claims 1 through 10, characterized in that said solid-state laser oscillator (1) is embodied as pulsed diode laser.
16. Arrangement in accordance with any of claims 1 through 15, characterized in that a polarizer (43) and a lambda quarter plate (42) or a Faraday isolator are arranged downstream of said laser amplifier (2) for avoiding interference from an application in the solid-state laser oscillator (1).
17. Arrangement in accordance with any of claims 1 through 16, characterized in that at least one non-linear optical crystal for wavelength transformation is arranged downstream of said laser amplifier (2) for generating ultrashort laser pulses in the UV range.
18. Method for generating ultrashort laser pulses by selecting pulses with reduced pulse repetition rates from a primary pulse sequence and by amplifying the selected pulses with a multistage laser amplifier that has no resonator with respect to the pulse to be amplified and from which the amplified pulses are decoupled free of active switching procedures, whereby the amplification is connected to no more than one double pass by amplifying media provided in the amplifier stages and whereby the selected pulses in each amplifier stage are amplified with small-signal amplification of more than 10, but at least however with total

small-signal amplification of more than 100.